Estimating Total Length of Headless Anglerfish, *Lophius americanus*, Landed in Maine

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ABSTRACT—Whole assorted anglerfish, Lophius americanus, *were obtained from eight locations along the Maine coast through prior arrangement with commercial dragger fishermen. Measurement of total length (L_T) and the distance from the anterior point of the 4th cephalic dorsal spine to the caudal fin (L_{CDS4}) was recorded for each fish. The slope, y-intercept, and correlation coefficient were calculated for the linear relationship L_T:L_{CDS4}.*

Polystyrene fish measuring strips were calibrated and marked in increments of 0.685 cm calculated from the above linear relationship. Each increment of 0.685 cm was equivalent to 1 cm and was marked as such on the strip. Measuring strips were calibrated to correct for a significant negative y-intercept value. Strips were inserted into slots on a special measuring board and two guide markers (ice picks) were positioned vertically at the 0 mark. Anglerfish tails from commercial vessels were placed on top of the strips and aligned between the two markers so that the anterior point of the 4th cephalic dorsal spine intercepted a line sighted between them. The estimated total length of the fish to the nearest cm was then read directly from the strip.

Introduction

The anglerfish, *Lophius americanus*, is a familiar species along the coast of eastern North America, ranging from the Grand Banks of Newfoundland and the northern side of the Gulf of St. Lawrence southward to North Carolina. They are found from shoal to moderately deep water of at least 365 fathoms on the continental slope off southern New England (Bigelow and Schroeder, 1953).

Anglerfish are commonly called "monkfish" (Maine), "goosefish" (Massachusetts), "molligut" (Connecticut), and "allmouth" (Carolina) (Dahlgren, 1928). The anglerfish is a close relative of the European species *Lophius piscatorius* (Wheller, 1969), which occurs in the eastern Atlantic from the Faroe Islands southward to the Cape of Good Hope (Bigelow and Schroeder, 1953). It is this close relative that was first observed and described by Aristotle under a Greek name which means frog-like fish (Dahlgren, 1928).

Although the anglerfish is not exceptionally abundant in the Gulf of Maine, it is consistently caught in commercial otter trawls. The catch per unit effort for this species runs from 5 to 16 pounds/hour towed and appears to be widely distributed along the Maine coast (Creaser and Lyons[1]).

The anglerfish is an excellent food fish, well flavored, white-meated and relatively free of bones when prepared properly (Bigelow and Schroeder, 1953). It also has a relatively high

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[1]Creaser, E. P., and K. M. Lyons. 1984. Annual report - Gulf of Maine model proposal, groundfish sampling. NMFS Northeast Fisheries Center, Woods Hole, Mass., 53 p.

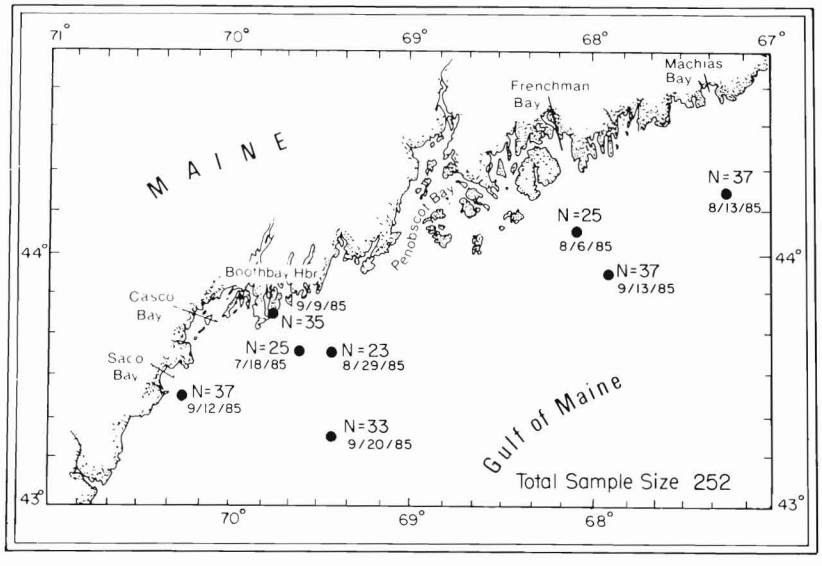


Figure 1.—Locations where anglerfish samples were obtained.

landed value, steadily increasing from $4,030 for 31,000 pounds in 1974 to $858,000 for 1,144,000 pounds in 1985. Still, little is known about the length composition of these species landed from Maine commercial fishing vessels, because they are landed with the head and shoulders removed. This study was made by port sampling personnel of the Maine Department of Marine Resources to develop a method of converting anglerfish tail lengths directly into total lengths at unloading facilities.

Materials and Methods

Anglerfish Collection

Anglerfish of varying sizes used in our study were obtained from areas representative of the entire Maine coast (Fig. 1) through prior arrangement with commercial fishermen who used otter trawls. Fish were ungutted, usually ice-cooled, and landed with heads intact. Sample size at each location was small (23-37 fish) because the commercial catch of this species is small. Fish were obtained from commercial operations (as opposed to research tows) because it was desirable to duplicate the conditions fish were subjected to prior to being landed commercially.

Measurements

Two measurements were obtained from whole fish supplied by commercial fishermen. Total length (L_T) was recorded in millimeters using a measuring board with a headstop, and measuring from the anterior edge of the lower jaw to the end of the caudal fin. It was necessary to grasp the upper and lower jaw at the corner of the mouth between the thumb and index finger and compress the anglerfish's mouth to a "standard closed position" before positioning the lower jaw against the headstop.

The tail section was removed from the anglerfish by cutting as indicated by dotted lines in Figure 2A. The resulting tail piece, with the anterior point of the 4th cephalic dorsal spine exposed, is shown in Figure 2B. The tail was measured on a board previously described by Creaser and Lyons (1985) (Fig. 3). The only change from the original board involved the use of two guide markers (ice picks) spaced 16 cm apart and inserted vertically into two holes located at the 0 mark (Fig. 3A). The tail section was aligned between the two markers so the anterior point of the 4th cephalic dorsal spine intercepted a line or sighting between them (Fig. 3B). The distance between this reference point and the end of the caudal fin (L_{CSD4}) was recorded in millimeters.

The anterior point of the 4th cephalic dorsal spine was chosen as the point of reference because it was the most anterior fixed point of measurement available. This point was nearly always exposed when the anglerfish tail was removed by commercial fishermen. The exact location of the cut is so consistent that the reference point is rarely damaged.

The anus was also considered as a point of measurement but it was located posterior of the tail cut and the tissue surrounding it was flacid and exhibited considerable movement.

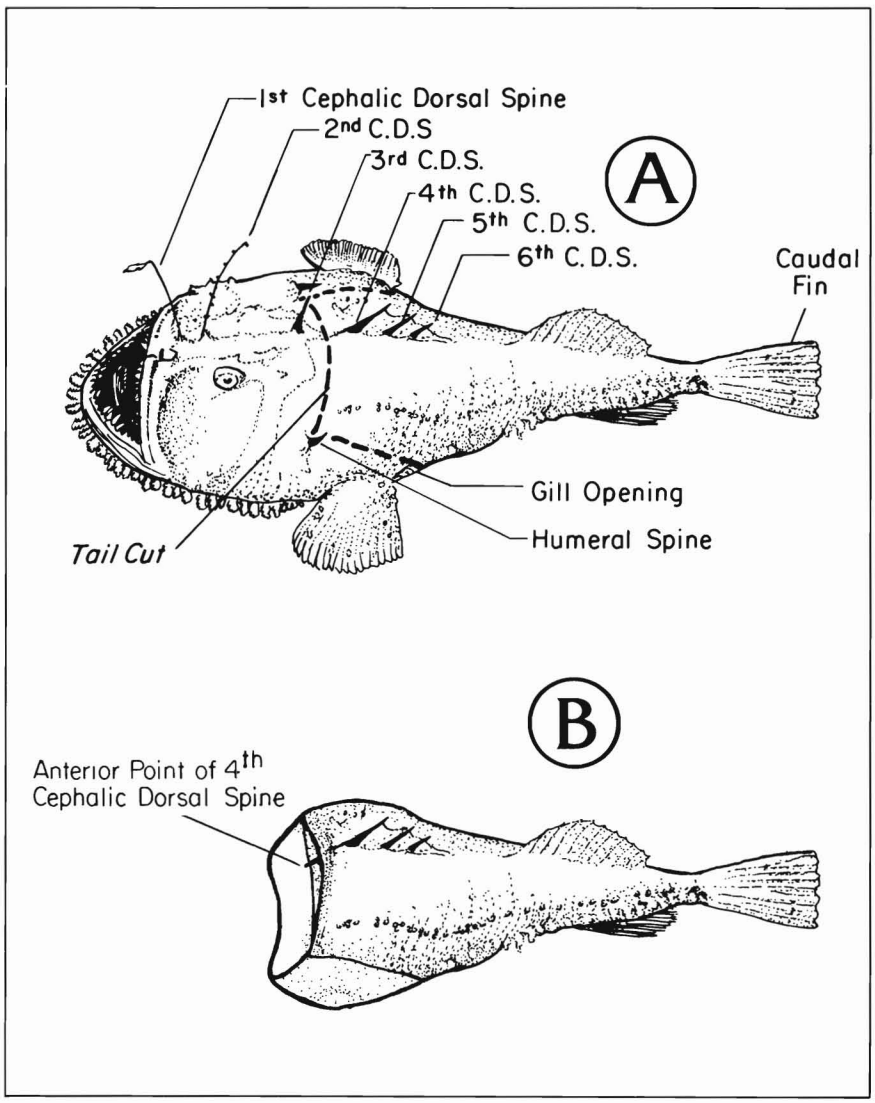


Figure 2.—Anglerfish and tail section: A) Labeled figure (dashed line denotes area of tailcut) and B) tail section as unloaded from commercial fishing boats.

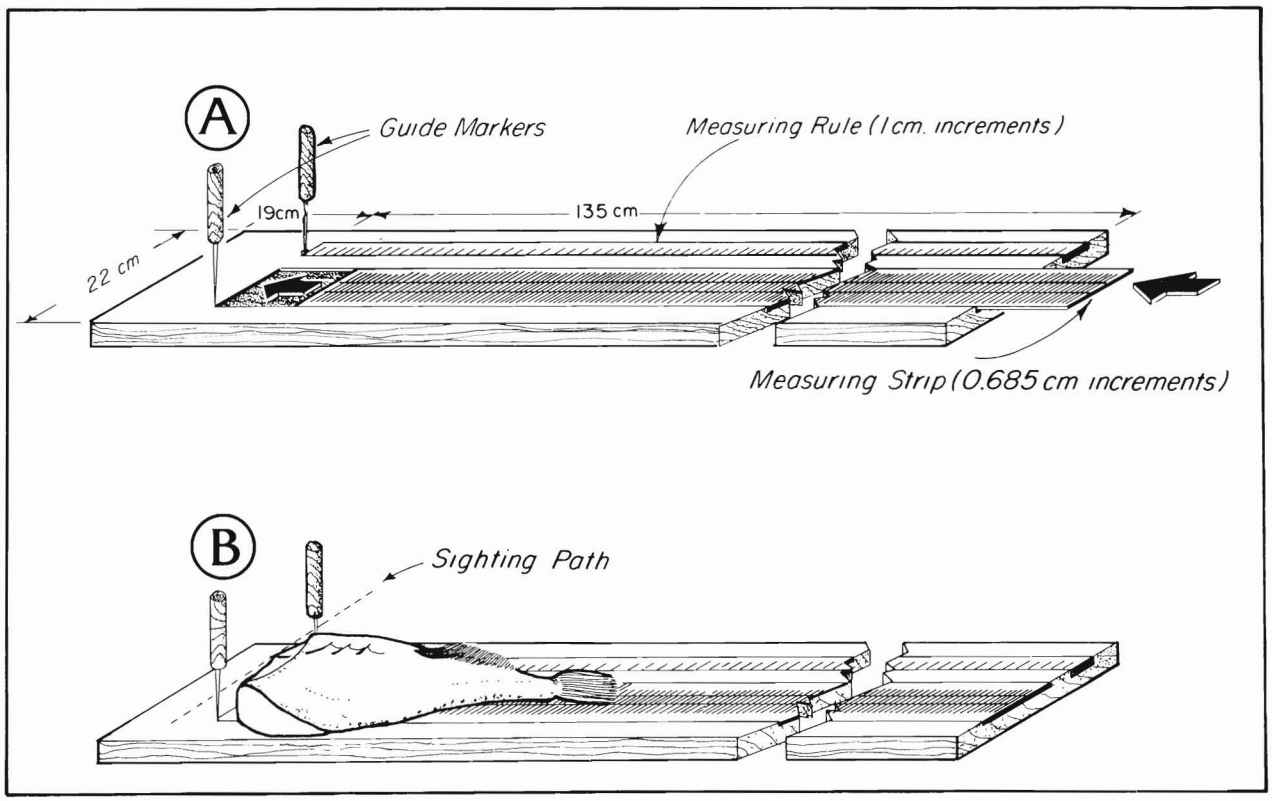
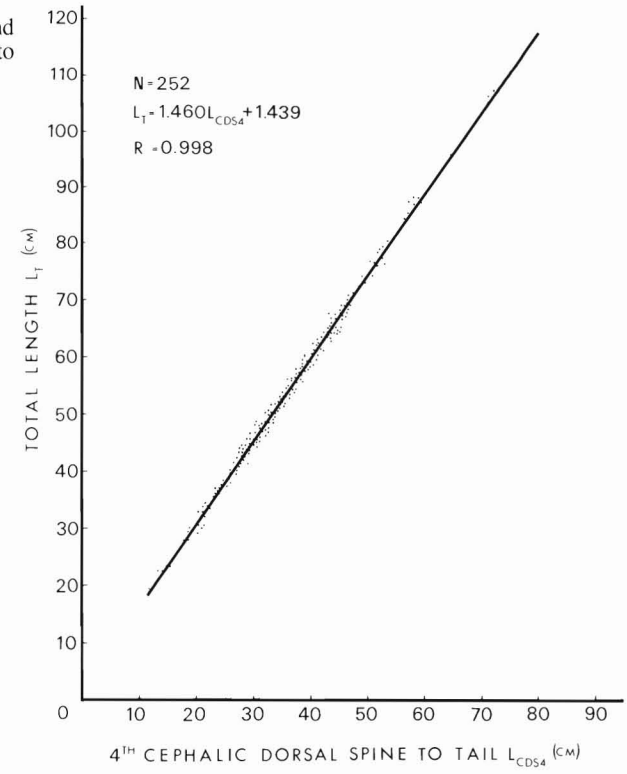


Figure 3.—The modified measuring board:
A) Component parts and B) measuring procedure.

Figure 4.—The relationship between L_T (total length) and the measurement L_{CDS4} (4th cephalic dorsal spine to caudal fin).



Results and Discussion

The linear relationship L_T:L_{CSD4} (Fig. 4) was calculated from combined data from eight sample locations. Figure 4 shows that a highly significant correlation coefficient of 0.998 exists.

The design and calibration of measuring strips used in this study is similar to that discussed by Creaser and Lyons (1985). The equation of the linear regression for L_T:L_{CDS4} is:

$$L_T = 1.460\ L_{CDS4} + 1.439. \quad (1)$$

Then solving equation (1) for L_{CDS4}, we find:

$$L_{CDS4} = 0.685\ L_T - 0.986.$$

Construction and Calibration

Fish measuring strips were constructed of polystyrene and measured 7.6 cm (width) × 101.6 cm (length) × 1.6 mm (thickness). Numbers and calibration increments were applied using silk screening techniques.

Measuring strips were calibrated and marked in 0.685 cm increments corresponding to the slope value of the linear relationship L_T:L_{CDS4}. Each increment was equivalent to 1 cm in length, rounded to the nearest centimeter, and was marked as such on the strip. The first increment was half the width of the following increments because lengths combined within each centimeter grouping included measurements 0.5 cm below and 0.5 cm above that grouping (Schultz[2]).

For instance, a fish measuring between 30.5 and 31.4 would be read as 31 cm (L_T) on the strip. It was necessary to modify the calibration of the strips and incorporate a correction for the y-intercept value, because this value (−0.986) was significantly different from 0 at 95 percent confidence limits. This was accomplished by subtracting a constant, or scaling factor, equivalent to the y-intercept value, to each calibrated increment on the strip (Fig. 5).

Calibrated measuring strips were inserted into the slot on the modified measuring board (lacking a headstop), and positioned next to the guide markers (Fig. 3A). The anglerfish tail was placed on the strip and positioned so that the anterior point of the 4th cephalic dorsal spine intercepted the sighting path between the two guide markers. A pencil mark was then placed at the end of the caudal fin in the appropriate space which was numbered to correspond to the total length of the fish. Pencil marks from a No. 1 pencil were easily removed with liquid or powdered detergents; thus, the strips were reusable (Creaser and Lyons, 1985).

The application of calibrated measuring strips appears to be a very quick and reliable means of converting anglerfish tail lengths directly into estimated total lengths at commercial unloading sites.

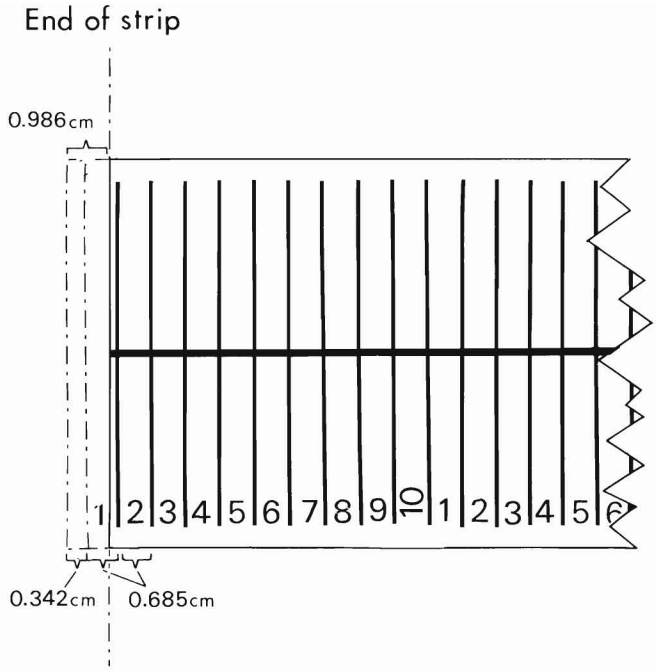


Figure 5.—The calibrated measuring strip for estimating L_T (4th cephalic dorsal spine to caudal fin).

[2]Schultz, R. L. 1974. Manual for sampling, interviewing, and coding for the Northeast Region. U.S. Dep. Commer., NOAA, NMFS Stat. Market News Div., Gloucester, Mass., 144 p.

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